Journal of the Society of Arts.

FRIDAY, AUGUST 27, 1869.

Announcements by the Council.

Examinations, 1870.

The Council have this year decided to remove from the Programme those subjects in which the Science and Art Department holds examinations, which, it appears, are now largely taken advantage of by the same class of persons (and very often by the same individuals) as those who sit at the Society's examinations. The following subjects will therefore not appear in the programme for 1870:—

Algebra.	Light and Heat.
Geometry.	Chemistry.
Trigonometry.	Mining and Metallurgy.
Conic Sections.	Botany.
Navigation, &c.	Animal Physiology.
Principles of Mechanics.	Free-hand Drawing.
Practical Mechanics.	Practical Geometry.
Magnetism, Electricity, &c.	Mechanical Drawing.

Owing to a prize of £5 having been kindly offered by Earl Fortescue, President of the British Branch of the International Decimal Association, the subject of the Metrical System will be retained.

The programme is now in preparation, and will include some further modifications in the system, but the above, being by far the most important, are announced at the earliest opportunity.

Designs for Channel Steamers.

The very defective state of the accommodation afforded by the Channel steamers, plying between this country and the Continent, having been brought under the notice of the Council, they have determined to offer the Gold Medal of the Society, and the large Silver Medal of the Society, for the best and the second-best block model of a steamer, which shall afford the most convenient shelter and accommodation to passengers on the deck of the vessel crossing the Channel between France and England. The steamer is not to exceed in tonnage and draught the best vessels now in use between Folkestone and Boulogne, and the model must be on a scale of a quarter of an inch to a foot. The models, marked in cypher, are to be sent in to the Society of Arts' House, John-street, Adelphi, on or before the 1st November, 1869, with a sealed envelope, giving the name and address of the designer.

The Council reserve the right of withholding either or both medals, in case, in their opinion, the models sent in do not possess sufficient merit.

The following particulars of the South-Eastern Channel steamers, *Victoria*, *Albert Edward*, and *Alexandra*, are given for the convenience of competitors, but it is not intended to confine the designs to them, except as to tonnage and draught:—

Length between perpendiculars, 200 ft.
Breadth of beam, 24 ft.
Depth underside of deck amidships, 12 ft. 6 in.
Draught of water, 7 ft.
Bow, clipper.
Stern, elliptic.
Rig, polacca with two masts, lug foresail, gaff mainsail, staysail, and flying jib.
Engines, oscillating.
Paddle wheels, 17 ft. 6 in. diameter.
Tonnage, 568 tons.
Speed, 17 miles an hour.

Subscriptions.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of Institutions.

EXAMINATION PAPERS, 1869.

(*Continued from page 773.*)

The following are the Examination Papers set in the various subjects at the Final Examination held in April last:—

PRACTICAL MECHANICS.

THREE HOURS ALLOWED.

1. Give some form of cam which, when acting upon a reciprocating bar by uniform rotation, will cause the up and down motions of the bar to have an interval of rest between each.
2. Explain the principle upon which flat bands are prevented from slipping off their pullies. How would you arrange to communicate motion between two shafts, neither parallel, nor meeting in a point, by a pair of pullies and an endless band? Why does the band slip off at once if the pullies are turned in a reverse direction?
3. Describe a ratchet-wheel. In what manner can a wheel without teeth, and movable by a frictional grip, be made to do the work of a ratchet-wheel? Contrast this contrivance with the arrangement of two pauls or clicks, whereby a ratchet-wheel of 60 teeth, for example, may be made to do the work of one with 120 teeth.
4. Describe the various parts of a planing machine. What are some of the modes of giving the backward and forward motion to the table? How is the length of motion of the table adjusted?
5. What is the principle of the slide rest, and why is it so superior to the common rest? Describe the method of using change wheels in a screw-cutting lathe, giving any numerical example which occurs to you.
6. Show how to produce a motion suitable for a boring machine, by a combination of toothed wheels and a screw.
7. Describe the construction of a rope, showing how it retains its twist. Explain the principle of the machinery employed for twisting strands into a rope?

8. Describe the manner in which the steam acts in a condensing beam engine, stating the general disposition of the moving parts and the objects which they fulfil. Make a sketch of the steam cylinder, steam ports, and slide-valve, so as to explain the method of admitting the steam into the cylinder and of allowing it to pass into the condenser.

9. How is the slide-valve of an engine worked by an eccentric? Show that this contrivance is the same as that of the crank and connecting rod, so far as the modification of motion is concerned.

10. Describe some form of balanced valve which will not be affected by steam pressure.

11. State approximately how much water should be pumped into the boiler of a locomotive for every cubic foot of steam, at 60 lbs. pressure, consumed in the cylinder. Sketch the feed-pumps and valves necessary for this purpose.

12. Describe Watt's parallel motion. In what manner should you arrange this parallel motion in the case of a double cylinder condensing engine, where the ends of two piston rods and of the air-pump rod are all three required to describe parallel straight lines?

ELECTRICITY AND MAGNETISM.

THREE HOURS ALLOWED.

1. Describe the construction of a mariner's compass. By what arrangement of needles may some kind of deviation be obviated?

2. What are the ordinary diurnal variations of terrestrial magnetism, and how have they been accounted for?

3. State some experiments which shew the phenomena of dia-magnetism.

4. What theory of the nature of electricity do you consider most in accordance with the present state of knowledge?—give some experimental illustrations.

5. Distinguish between an electrometer and an electroscope; and describe the condensing electroscope.

6. On what conditions does the efficiency of a lightning conductor depend?

7. In what respects does Franklinic differ in quality from Voltaic electricity; and how may they be shown to be identical?

8. What is an "astatic" needle, and what is its position of equilibrium, when the two needles are equal in force, and *very nearly* parallel?

9. Describe a tangent galvanometer, and explain its use.

10. Describe and explain the experiment of a wire conducting a current which rotates round a permanent magnet, or *vice versâ*.

11. Describe the construction of some magneto-electric telegraph now in use.

12. Explain the construction of some working submarine cable, and the method of testing its insulation.

13. How is an induction-coil machine constructed, and by what means may the shocks be intensified?

14. Describe the process of electro-plating.

15. By what means may the current be most economically generated for electro-metallurgy on the large scale?

16. Explain the means of producing a thermo-electric current, and state what is its peculiar character?

17. What electric phenomena are manifested by portions of nerve and muscle of a recently killed animal?

18. If a limb and its nerve be detached from a recently killed animal, what phenomena result from electric action on the nerve?

LIGHT AND HEAT.

THREE HOURS ALLOWED.

GEOMETRICAL OPTICS.

1. Give the definition of a ray of light and a pencil of rays, and also the definition of the brightness or intensity of a pencil of light. When rays of light diverge from a luminous point, what is the law of the intensity at different distances from it? Show how it arises that opaque objects, such as the page of a book, appear equally bright at different distances from the eye.

2. Enunciate the law of the reflexion of light at polished surfaces of media, and prove the property of the two plane mirrors which are used in Hadley's sextant, employed in taking astronomical observations at sea. Describe the construction of that instrument and the mode of using it.

3. Explain what is meant by the *chromatic dispersion* in the refraction of light by transparent media. Show how the dispersive power of a medium can be expressed in terms of the deviations of the different coloured rays transmitted by a prism of a small refracting angle. Show how the dispersive power of the glass affects the *image of a star* formed by a convex lens.

4. Describe the construction of the common compound microscope. Show how the magnifying power arises, by comparing the magnitude of the object seen by the naked eye with that of the image seen through the instrument.

PHYSICAL OPTICS.

5. Explain what is meant by the property of *periodicity* in light, and explain how interference arises in light from this property. Show how the colours of the soap-bubble and Newton's rings arise from the interference of light.

6. Give some illustration of the property of light which is called *polarization*, by showing some case where polarized light produces different phenomena to common light. How are the two rays in double refracting crystals related in this respect?

7. When the eye is turned towards a distant flame of a candle, and a hair of the head comes between the pupil of the eye and the candle-flame, describe the appearances which are seen, and give the explanation of them on the doctrine of interferences.

8. Explain what is meant by the *circular polarization* of liquids. As the value of certain substances depends on the quantity of sugar which they contain, describe some method by which their value can be found by the polariscope.

HEAT.

9. Explain what is meant by the convection of heat. When a hot body cools in the air, show how the heat is lost by it. When hot bodies are required to be protected from this loss, what are the means to be employed?

10. Explain the construction of the maxima and minima self-registering thermometers. Describe some eases where such thermometers must necessarily be employed.

11. When vapours arise from solids and liquids at ordinary temperatures, to what cause is this attributable? Describe some instrument which can be used as a *hygrometer*, for showing the wetness or dryness of the air.

12. Explain the principle on which *hot-air* engines have been constructed. How is force obtained from the heat employed in such engines? If *olefiant gas* could be used in place of air, how would the amount of force produced by a given quantity of heat be affected by such change?

(To be continued.)

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1869.

The following is a list of Papers read in the various Sections:—

THURSDAY, AUGUST 19TH.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

Introductory Address by Professor Sylvester, President of the Section.

W. R. Birt—Report of the Lunar Committee.

Professor P. G. Tait—Provisional Report on the Repetition and Extension of Professor Forbes' Experiments on Thermal Conductivity.

G. J. Symons—Report of Committee on Underground Temperatures.

W. R. Birt—On Secular Variations of Lunar Tints.

W. R. Birt—On Spots and Shadows on the Lunar Crater Plato.

Professor G. C. Foster—Description of some Lecture Experiments in Electricity.

J. H. Gladstone—On the Relation between the Specific Refractive Energies and the Combining Proportions of Metals.

G. J. Symons and R. Field—On the Best Means of Determining the True Evaporation from the Surface of Water.

C. J. Woodward—On a Self-setting Type-machine Recording the Horizontal Motion of the Air.

— Martin—Description of a New Self-recording Aneroid Barometer.

Section B.—Chemical Science.

The President's Address.

Herbert McLeod—Report on the Determination of the Gases existing in Solution in Well Waters.

A. Matthiessen—Report of the Committee on the Chemical Nature of Cast-iron.

M. Jacobi—On Electrolytic Iron.

J. Moffat—On the Phosphorescence of the Sea and Ozone in connection with Atmospheric Conditions.

J. Moffat—On the Oxidation of Phosphorus and the quantity of Phosphoric Acid excreted by the Kidneys in connection with Atmospheric Conditions.

C. Tomlinson—On a Remarkable Structural Appearance in Phosphorus.

Section C.—Geology.

The President's Address.

R. A. C. Godwin Austen—The Devonian Group considered Geologically and Geographically.

J. M. Duncan, M.D.—Second Report of the Committee on British Fossil Corals.

J. Thompson—Report of the Committee on Sections and Photographs of Coral.

G. W. Ormerod—Sketch of Granite of the Northernly and Easternly sides of Dartmoor.

W. Pengelly—Course of the Miocene Clays of Bovey Tracy.

T. Davidson—Notes on the Brachiopoda hitherto obtained from the "Pebble Bed" of Budleigh Salterton.

E. Hull—On the Source of the Quartzose Conglomerates of the New Red Sandstones of Central England.

H. Woodward—Fresh Water Deposits of the Valley of the River Lea, in Essex.

Section D.—Biology (Department of Zoology and Botany.)

H. E. Dresser—Report of the "Close-time" Committee.

Rev. H. B. Tristram, F.R.S.—On the Effect of Legislation on the Extinction of Animals.

F. F. Hallett—On the Law of the Development of Cereals.

R. O. Cunningham—On the Flora of the Straits of Magellan and West Coast of Patagonia.

R. O. Cunningham—On *Chionis alba*.

C. E. Broome—On a lately discovered *Mixogaster*.

W. P. Hiern, M.A.—On the Occurrence of *Rapistrum rugosum*, All., in Surrey, Kent, and Somersetshire.

Section D.—Biology (Department of Anatomy and Physiology.)

B. W. Richardson, F.R.S.—Report on the Physiological Action of the Methyl Series.

E. Ray Lankester—Report on the Spectroscopic Examination of Animal Substances.

Rev. W. V. Harcourt—The Solution of Uric Acid Calculi, and the Quantitative Analysis of Uric Acid.

Dr. Wilson—The Moral Imbecility of Habitual Criminals exemplified by Cranial Measurements.

Section E.—Geography.

The President's Opening Address.

Dr. R. J. Mann—Erskine's Discovery of the Mouth of the Limpopo.

Dr. Beke—On a Canal to Unite the Upper Nile and Red Sea.

J. Stirling—Visit to the Holy City of Faz, in Morocco.

Captain T. P. White, R.E.—Bifurcating Stream in Perthshire.

Captain C. Dodd—Recent Visit to the Suez Canal.

Lieut.-Col. A. Strange, F.R.S.— On a small Alt-azimuth Instrument for the use of Explorers.

Section F.—Economic Science and Statistics.

The President's Address.

Canon Girdlestone—Maintenance of Schools in Rural Districts.

J. Bailey Denton—Technical Education of the Agricultural Labourer.

James Hunt Holley—Remarks on the Need of Science for the Development of Agriculture.

Dr. L. Lindsay—The Sutherland Gold Diggings as a Scientific and Social Experiment.

John Glover—Decline of Ship-building on the Thames.

Section G.—Mechanical Science.

President's Address.

W. Fairbairn, F.R.S., LL.D.—Further Report on the Mechanical Properties of Steel.

Colonel H. Clerk, R.A., F.R.S.—Description of the Hydraulic Buffer, and on the Flow of Liquids through Small Orifices at High Velocities.

R. Eaton—On Certain Economical Improvements in obtaining Motive Power.

FRIDAY, AUGUST 20th.

Section A.—Mathematical and Physical Science.

Lieut.-Col. Strange — Report of the Committee for Recommending Increased Facilities for Scientific Investigations.

Lieut.-Col. Strange—On the Best Forms of Numerical Figures for Scientific Instruments, and on a Proposed Mode of Engraving them.

Prof. Gustav Magnus—On the Absorption, Emission, and Reflection of Heat.

Prof. W. J. Macquorn Rankine — Summary of the Thermodynamic Theory of Waves of Finite Longitudinal Disturbance.

Rev. Dr. Robinson—On the Appearance of the Nebula in Argo as seen in the great Melbourne Telescope.

Rev. R. Main— Remarks on the British Association Catalogue of Stars.

Rev. R. Main — On the Longitude of the Radcliffe Observatory, Oxford, as deduced from Meridional Observations of the Moon, made at Greenwich and Oxford, in the years 1864-8.

Rev. R. Main—On the Discordance usually observed between the Results of Direct and Reflexion Observations of North Polar Distance.

Prof. P. G. Tait—On Comets.

J. P. Gassiot—On Metallic Deposits in Vacuum Tubes.

Rev. Prof. Jellett—On a Method by which the Formation of certain Chemical Compounds may be Optically Established.

SECTION B.—CHEMICAL SCIENCE.

B. H. Paul—Report on Treatment and Utilisation of Sewage.

F. Braby—On Extraction of Ammonia from Gas Liquor.

Stevenson Macadam—On the Economic Distillation of Gas from Cannel Coal.

Walter Weldon—On the Manufacture of Chlorine by means of Perpetually Regenerated Manganite of Calcium.

T. L. Phipson—On some New Substances extracted from the Walnut.

T. L. Phipson—On the Solubility of Lead and Copper in Pure and Impure Water.

W. J. Russell—On the Measurement of Gases as a Branch of Volumetric Analysis.

C. Tomlinson—On the Supposed Action of Light on Combustion.

Crace Calvert—On the Amount of Soluble and Insoluble Phosphates in Wheat Seed.

H. Sorby—On Jargonia.

SECTION C.—GEOLOGY.

W. Pengelly—Fifth Report of the Committee on the Exploration of Kent's Cavern; with Notes on the Mammalian Remains—By W. Boyd Dawkins and W. A. Sanford.

H. H. Howorth—On the Extinction of Mammoth.

W. Pengelly—On the Alleged Occurrence of *Hippopotamus major* and *Machairodus latidens* in Kent's Cavern.

W. H. Bailey—Report of the Committee on the Fossils of Kiltorcan, Co. Kilkenny.

C. Moore—On a Specimen of Teleosaurus from the Upper Lias.

G. Maw—On the Trappean Conglomerates of Middletown-hill, Montgomeryshire.

J. Thomson—On Teeth and Dermal Structure associated with Ctenacanthus.

W. Carruthers—On Reptilian Eggs from Secondary Strata.

W. Carruthers—On "Slickensides."

Pierre de Tchihatchef—Paleontologie de l'Asie Mineure.

H. Woodward—On the Occurrence of Stylonurus in the Cornstone of Hereford.

H. Woodward—On the Discovery of a Large Myriapod of the genus *Euphoberia* in the Coal Measures of Kilmaurs.

SECTION D.—BIOLOGY.

Professor Dickson—To exhibit a specimen of *Primula sinensis*, in which short styles are accompanied by short stamens.

W. Carruthers, F.L.S.—Report on the Fossil Flora of Britain.

Rev. A. M. Norman, F.L.S.—Letter from Professor Wyville Thomson on the Successful Dredging of H.M.S. *Porcupine* in 2,435 fathoms.

Archdeacon Freeman—Man and the Animals, being a Counter Theory to Mr. Darwin's, as to the Origin of Species.

Rev. F. O. Morris—The Difficulties of Darwinism.

SECTION E.—GEOGRAPHY.

Sir Bartle Frere, K.C.B.—On the Runn of Cutch.

M. de Khanikof—Sur la Latitude de Samarcand.

Pierre de Tchihatchef—Central Asia.

George Peacock, F.R.G.S.—Encroachment of the Sea on Exmouth Warren.

Dr. G. Oppert—On the Kitai and Kara Kitai.

Captain C. Dodd—Notes on the Runn of Cutch.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

The Report of the Committee on Uniformity of Weights and Coins in the Interest of Science.

Dr. Farr—On International Coinage.

W. H. U. Sankey—On Weights and Measures.

Professor Leone Levi—On the Economic Condition of the Agricultural Labourer in England.

Professor Leone Levi—On Agricultural Economics and Wages.

Frederick Purdy—Statistical Notes on Mr. J. B. Lawes' Agricultural Experiments.

SECTION G.—MECHANICAL SCIENCE.

Professor Rankine, F.R.S.—Interim Report of Committee on the Laws Governing the Flow and Action of Water containing Solid Matter in Suspension.

Professor Rankine—Interim Report from the Committee on Agricultural Machinery.

F. J. Bramwell—On the Laws Determining the Fracture of Materials when Sudden Changes of Thickness take place.

J. F. Bateman, F.R.S.—On the Channel Railway.

Admiral Sir Edward Belcher, K.C.B., F.R.S.—On a Navigable Floating Dock.

SATURDAY, AUGUST 21ST.

SECTION A.—MATHEMATICAL AND PHYSICAL SCIENCE.

W. H. L. Russell—Report on the Recent Progress in the Theory of Elliptic and Hyper-Elliptic Functions.

E. Vivian.—On a new Mean Self-registering Hygrometer.

Prof. Sylvester.—On Prof. Christian Wiener's Stereoscopic Representation of the Cubic Eikosi-Heptagram.

W. K. Clifford.—On the Umbili of Anallagmatic Surfaces.

W. K. Clifford.—On the Theory of Distances.

R. B. Hayward.—Sketch of a Proof of Lagrange's Equations of Motion referred to Generalised Coordinates.

F. W. Newman.—On Conic Osculation.

F. W. Newman.—On Surfaces of the Second Degree.

F. W. Newman.—On Curves of the Third Degree.

M. Collins.—On the Common Tangents of Circles.

SECTION B.—CHEMICAL SCIENCE.

This Section did not meet on Saturday.

SECTION C.—GEOLOGY.

J. Randall—On the Denudation of the Shropshire and Staffordshire Coal Field—Communicated by W. W. Smyth.

C. Le Neve Foster—On the Occurrence of the Mineral Scheelite at Val Toppa Gold Mine, near Domodossola, Piedmont.

J. E. Taylor—On certain Phenomena in the Drift, near Norwich.

J. E. Taylor—The Water-bearing Strata in the Neighbourhood of Norwich.

G. A. Lebour—Denudation of Western Brittany—Communicated by R. A. C. Godwin-Austen.

G. A. Lebour—Notes on some Granite of Lower Brittany.

H. A. Nicholson—On some New Forms of Graptolites—Communicated by the President.

SECTION D.—BIOLOGY.

This Section did not meet on Saturday.

SECTION E.—GEOGRAPHY.

This Section did not meet on Saturday.

SECTION F.—ECONOMIC SCIENCE AND STATISTICS.

James Heywood, M.A., F.R.S.—On the Examination Subjects for Admission into the College for Women at Hitchin.

Rev. W. Tuckwell, M.A.—On the Method of Teaching Physical Science.

Jesse Collings—Some Statistics of the National Educational League.

Raphael Brandon—Some Statistics of Railways in their Relation to the Public.

James Stark, M.D.—Contributions to Vital Statistics.

P. M. Tait—Vital Statistics of Bombay.

Robert Main—On Naval Finance.

Hyde Clarke, F.S.S.—On the Want of Statistics on the Question of Mixed Races.

Hyde Clarke, F.S.S.—On the Rapidity of Human Thought.

Hyde Clarke, F.S.S.—On the Distinction between Rent and Land-tax in India.

Section G.—Mechanical Science.

This Section did not meet on Saturday.

MONDAY, AUGUST 23rd.

Section A.—Mathematical and Physical Science.

Sir E. Belcher—Report of the Committee appointed to apply to the Admiralty for Aid in Observing Certain Sea Temperatures.

Professor Rankine—Report of the Tidal Committee.

G. J. Symons—Report of the Rainfall Committee.

Dr. Neumayer—Recent Fall of an Aërolite at Krähenburg.

J. Glaisher—Results of Experiments with a Captive Balloon.

Dr. R. J. Mann—On the Rainfall in Natal.

Dr. Hudson—On the Formation of Dew.

A. E. Fletcher—On a New Anemometer.

F. J. Mott—On the Maury Barometer.

— Warner—On Chambered Spirit-levels.

Section B.—Chemical Science.

S. Williams—On the Action of Phosphoric-chloride on Hydric-sulphate.

J. Dewar and G. Cranston—On some Reactions of Chloro-sulphuric Acid.

A. Matthiessen and C. R. Wright—On the Action of Hydrochloric Acid on Morphia and Codeia.

Dr. Andrews—On the Absorption Bands of Bile.

M. Janssen—Methode Spectrale pour la Recherche des Composés du Sodium.

M. Janssen—Sur le Spectre de la Vapeur d'Eau.

W. C. Roberts—On a Specimen of Obsidian from Java.

W. D. Michell—Are Flint Instruments of the First Stone Age found in the Drift?

Section C.—Geology.

C. Moore—Report of the Committee for the purpose of Investigating the Veins containing Organic Remains, which occur in the Mountain Limestone of the Mendips, and elsewhere.

H. Brady—Notes on Mr. Moore's Foraminifera, from Mineral Veins.

C. W. Peach—Notice of the Discovery of Organic Remains in the Rocks between the Nare-head and Porthalla Cove, Cornwall.

H. Bauerman—Report of the Committee on "Ice as an Agent of Geologic Change."

R. Brown—On the Elevation and Depression of the Coast of Greenland.

G. Maw—On Insect Remains and Shells from the Lower Bagshot Leaf-bed of Studland Bay, Dorsetshire.

J. Thomson—On New Forms of Pteroplax and other Carboniferous Labyrynthodonts, and of Megalicthys; with notes on their Structure, by Dr. Young.

Dr. Hicks—On the Discovery of Fossil Plants in the Cambrian Rocks (Upper Longmynds), near St. David's.

Dr. Mann—On the Gold of Natal.

L. C. Miall—Experiments in illustration of the Contortion of Rocks.

Section D.—Biology.

Sir John Lubbock, Bart.—On the Primitive Condition of Man, being some Remarks in answer to the "Speculations" of the Duke of Argyll.

Dr. P. M. Duncan—On the Age of the Human Remains in the Cave of Cro-Magnon, in the Valley of the Vezere.

Colonel Lane Fox—Flint Implements of Palæolithic Age from the Gravels of Ealing and Acton.

Rev. E. N. Dumbledon—Discovery of a Crannog in South Wales.

Rev. Dr. A. Hume—On the so-called "Petrified Human Eyes" from the graves at Arica, Peru.

Section E.—Geography.

Captain R. C. Mayne, R.N.—Recent Surveys in the Straits of Magellan.

Admiral Sir E. Belcher—On the Distribution of Heat on the Sea Surface throughout the Globe.

A. G. Findlay—On the Supposed Influence of the Gulf Stream on the Climate of N.W. Europe.

Captain R. V. Hamilton, R.N.—On the Best Route to the North Pole.

F. F. Searle—The Upper Amazons.

R. Edmonds—On Extraordinary Agitations of the Sea.

T. Wyatt Reid—Influence of Atmospheric Pressure on the Displacement of the Ocean.

Section F.—Economic Science and Statistics.

Frederick Purdy—On the Pressure of Taxation on Real Property.

Dr. W. Neilson Hancock—On Local Taxation in Ireland.

W. Botly—On the Condition of the Agricultural Labourer.

Section G.—Mechanical Science.

Lavington E. Fletcher—Report of the Committee on Boiler Explosions.

C. W. Merrifield, F.R.S.—Report of the Committee on the State of Knowledge of Stability and Sea-going Qualities of Ships.

Professor W. J. M. Rankine, F.R.S.—Report of the Committee for the Analysis and Reduction of Observations in Report of "Steam-ship Performance Committee."

R. B. Grantham—Report of the Committee on Sewage.

T. Login—On Roads and Railways in Northern India, as affected by the Abrading and Transporting Power of Water.

Joseph Whitworth, LL.D., F.R.S.—On the Penetration of Armour Plates by Shells with Heavy Bursting Charges, fired obliquely.

Lavington E. Fletcher—On Government Action with regard to Boiler Explosions.

TUESDAY, AUGUST 24th.

Section A.—Mathematical and Physical Science.

J. Whitworth, F.R.S.—On the Penetration of Armour Plates by Shells with Heavy Bursting Charges fired obliquely.

M. Janssen—Sur une Méthode pour obtenir les Images Monochromatiques des corps Lumineux.

M. Janssen—Faits divers de Physique Terrestre.

Professor A. Morren—On the Chemical Reaction of Light discovered by Professor Tyndall.

H. Hodson—On the Formation of Dew.

G. Johnstone Stoney—On the Numerical Relations between the Wave-lengths of the Hydrogen Rays.

G. Johnstone Stoney—On a Convenient and Cheap Heliostat.

C. Brooke—On the Influence of Annealing on Crystalline Structure.

W. H. L. Russell—On the Mechanical Tracing of Curves.

Prof. Sylvester—On the Successive Involutes to a Circle.

Hon. J. W. Strutt—On an Electro-Magnetic Experiment.

Section B.—Chemical Science.

E. C. C. Stanford—A Chemical Method of Treating the Excreta of Towns.

H. Bamber—On the Water Supplies to Plymouth, Devonport, and Exeter.

P. Spence—On the Production of Higher Temperatures by Steam of 212° Fahrenheit.

A. Oppenheim—On Bromo-Iodide of Mercury.

A. Oppenheim—On Benzo-Sulphuric Acid.

Professor Jellett—On a Method of Determining with Accuracy the Ratio of the Rotating Powers of Cane Sugar and Inverted Sugar.

Dr. Fritsche—Notes on Structural Change in Block Tin—Communicated by W. C. Roberts.

H. Cooke—On the Registration of Atmospheric Ozone in the Bombay Presidency, and the Chief Causes which Influence its Appreciable Amount in the Atmosphere.

J. Lowthian Bell—On the Decomposition of Carbonic Oxide by Spongy Iron.

Section C.—Geology.

J. Bryce—Report of the Committee on Earthquakes in Scotland.

W. S. Mitchell—Report of the Committee for the purpose of Investigating the Leaf-beds of the Lower Bagshot Series of the Hampshire Basin.

R. Etheridge—On the Occurrence of a large Deposit of Terra Cotta Clay at Watcombe, Torquay.

Rev. J. D. La Touche—An Estimate of the Quantity of Sedimentary Deposits in the River Onny.

J. L. Lobley—On the Distribution of the British Fossil *Lamellibranchiata.*

Rev. J. D. La Touche—On Spheroidal Structure in Silurian Rocks.

N. Whitley—On the Distribution of Shattered Chalk Flints and Flakes in Devon and Cornwall.

Professor Tennant—Diamonds received from the Cape of Good Hope during the last year.

J. Jeffreys—On the Action upon Earthy Minerals and Compounds, of Water in the form of Heated Steam, urged by Wood Fuel, &c.

J. W. Reid—On the Physical Causes which have produced the Unequal Distribution of Land and Water between the Hemispheres.

C. Jecks—On the Crag Formation.

J. E. Lee—Notice of Remarkable Glacial Striæ lately exposed at Portmadoc.

E. A. Conwell—On a Fossil Mussel Shell found in Drift in Ireland.

Section D.—Biology (Department of Botany, Zoology, and Ethnology).

M. T. Blanford—On the Relations of the Fauna of British India to that of the Ethiopian and so-called Indian Regions.

Robert Brown, F.R.G.S.—The Mammalian Fauna of North-West America.

H. Woodward, F.G.S.—On a New Isopod from Flinder's Island.

Ralph Tate, F.G.S.—On the Land and Fresh-Water Shells of Nicaragua, Central America.

W. F. Webb—Five years' experience in Artificial Fish-breeding, showing in what waters Trout will and will not thrive, with some remarks on Fish and our British Fisheries.

Frank Buckland—On the Salmon Rivers of Devon and Cornwall, and how to improve them.

Professor E. Perceval Wright—On *Rhinodon typicus,* the largest known Shark.

Dr. Scott—On a Hybrid or other variety of *Perdix cinerea* found in Devonshire.

Miss Lydia Becker—On Alteration in the Structure of *Lychnis diorcha,* observed in connection with the development of Parasitic Fungus.

A. Hancock, F.L.S., and Thomas Atthey—On some curious Fossil Fungi, from the Black Shale of the Northumberland Coal Fields.

Admiral Sir E. Belcher—Stone Implements from Rangoon.

Sir Duncan Gibb, Bart.—Paucity of Aboriginal Monuments in Canada.

W. C. Dendy—On the Primeval Status of Man.

A. L. Lewis—Notes on the Builders and the Purposes of Megalithic Monuments.

H. H. Howorth—Westerly drifting of the Nomades from the 5th to the 19th Century.

J. Bonwick—Origin of the Tasmanians.

Section D.—Biology (Department of Anatomy and Physiology).

K. Bridgman—Voltaic Electricity in Relation to Physiology.

Professor Cleland—On the Interpretation of the Limbs and the Lower Jaw.

Dr. Richardson, F.R.S.—Report on the Physiological Action of Chloral.

Dr. Burdon Sanderson, F.R.S.—Exhibited an Instrument for Recording Respiratory Movements.

H. Blanc, M.D.—Human Vaccine Lymph and Heifer Lymph compared.

J. C. Galton, M.A., F.L.S.—The Myology of Cyclothurus Didactylus.

Professor Cleland.—On the Human Peritoneum illustrated by that of the Wombat.

Dr. Heaton.—Further Observations on Dendroidal Forms assumed by Minerals.

Section E.—Geography.

Trelawney Saunders.—Cooper's Attempt to Cross from China to India.

Douglas Forsyth.—Trade Routes between Northern India and Central Asia.

Trelawney Saunders.—The Himalayas and Central Asia.

Dr. G. Newmayer.—Scheme for a Scientific Exploration of Australia.

W. P. Blanford.—Northern Abyssinia.

Dr. Birdwood—On the Geography of the Frankincense Plant.

Dr. C. Le Neve Foster.—On Raleigh's El Dorado.

Section F.—Economic Science and Statistics.

Dr. Robert Mann—On Assisted Emigration.

Archibald Hamilton—The Economic Progress of New Zealand.

James Heywood—On Municipal Government for Canadian Indian Reserves.

Sir J. Bowring—On Prison Laws as associated with Prison Discipline.

F. P. Fellowes—On our National Accounts.

Sir J. Bowring—The Devonshire Association for Advancement of Science and Art.

Section G.—Mechanical Science.

Professor Rankine—Report of the Tidal Committee.

Adjourned Discussion on Mr. L. E. Fletcher's paper on Boiler Explosions.

Thomas D. Barry—On the Utilisation of Town Sewage.

Latimer Clark—On the Birmingham Wire Gauge.

S. A. Varley—On a New System of Communication between Guards and Passengers on Railways.

G. J. Symons and Rogers Field—On a Method of Determining the True Amount of Evaporation from a Water Surface.

R. E. Froude.—The Hydraulic Internal Scraping of the Torquay Water Main.

W. Froude—Some Difficulties in the Received Views of Fluid Friction.

Professor T. C. Archer—Description of a New System of House Ventilation, by J. D. Morrison, of Edinburgh.

Professor T. C. Archer—On the Working of Thomson's Road Steamer during the past year.

W. Smith, C.E.—An Improved Vertical Annular High Pressure Steam Boiler.

J. T. Chillingworth—An Air Engine.

WEDNESDAY, AUGUST 25th.

Section A.—Mathematical and Physical Science.

J. Glaisher—Report of the Committee on Luminous Meteors.

T. Bruce-Warren—On Electrification.

F. H. Varley—On the Electrical Balance.

G. Johnstone Stoney—On Collimators for adjusting Newtonian Telescopes.

G. J. Symons—Exhibited a Storm Rain Gauge.

Balfour Stewart—On Meteorological Reductions, with especial reference to the Element of Vapour.

Balfour Stewart—On a Self-Recording Rain Gauge.

W. Huggins—On the Heat of the Stars.

Section B.—Chemical Science.

This Section did not meet.

Section C.—Geology.

This Section did not meet.

Section D.—Biology (Department of Botany, Zoology, and Ethnology).

C. Spence Bate, F.R.S.—Report on the Marine Fauna and Flora of the South Coast of Devon and Cornwall.

Dr. Maxwell T. Masters—Relative Value of the Characters employed in the Classification of Plants.

Dr. Birdwood—On the genus Boswellia, with Descriptions and Drawings of Three New Species.

W. Pengelly—Whale Remains washed ashore at Babbicombe, South Devon.

G. Gladstone, F.C.S.—Observations on Infusoria at Münster am Stein, Creuznach.

C. S. Wake—Initial Life.

Dr. R. King—On the Natives of Vancouver's Island.

W. S. Hall—The Esquimaux considered in their Relationship to Man's Antiquity.

Drs. R. S. Charnock and C. C. Blake—Notes on the Woolwa and Mosquito Vocabularies.

F. Drake—Human Remains in the Gravels of Leicestershire.

T. M. Hall—Method of forming Flint Flakes used by the Early Inhabitants of Devon.

R. Tate—Notes on an Inscribed Rock.

Sir D. Gibb, Bart.—An Obstacle to European Longevity beyond 70 years.

Sir D. Gibb, Bart.—A Cause of Diminished Longevity among the Jews.

R. Garner—On the Brain of a Negro.

H. H. Howarth—Frontier Line of Ethnology and Geology.

F. H. Kinahan—Race Elements of the Irish People.

C. S. Wake—Race Affinities of the Madecasses.

J. Stirling—Races of Morocco.

Section D.—Biology (Department of Anatomy and Physiology).

R. Garner—On the Homologies in the Extremities of the Horse.

Professor Crum Brown—On the Connection between Chemical Composition and Physiological Activity.

Dr. Kidd—On Sleep and Anesthetics.

Section E.—Geography.

This Section did not meet.

Section F.—Economic Science and Statistics.

Henry Dircks, C.E., LL.D.—Statistics of Invention, illustrating the Policy of a Patent Law.

Section G.—Mechanical Science.

This Section did not meet.

PROFESSOR HUXLEY ON SCIENTIFIC EDUCATION.

The following is extracted from a paper by Professor Huxley, which appeared in the June number of *Macmillan's Magazine* :—

The next question to which I have to address myself is, what sciences ought to be thus taught? And this is one of the most important of questions, because my side (I am afraid I am a terribly candid friend) sometimes spoils its cause by going in for too much. There are other forms of culture beside physical science, and I should be profoundly sorry to see the fact forgotten, or even to observe a tendency to starve or cripple literary or æsthetic culture for the sake of science. Such a narrow view of the nature of education has nothing to do with my firm conviction that a complete and thorough scientific culture ought to be introduced into all schools. By this, however, I do not mean that every schoolboy should be taught everything in science. That would be a very absurd thing to conceive, and a very mischievous thing to attempt. What I mean is, that no boy or girl should leave school without possessing a grasp of the general character of science, and without having been disciplined, more or less, in the methods of all sciences; so that, when turned into the world to make their own way, they shall be prepared to face scientific discussions and scientific problems, not by knowing at once the conditions of every problem, but by being able at once to solve it; but by being familiar with the general current of scientific thought, and being able to apply the methods of science in the proper way, when they have acquainted themselves with the conditions of the special problem.

That is what I understand by scientific education. To furnish a boy with such an education, it is by no means necessary that he should devote his whole school existence to physical science; in fact, no one would lament so one-sided a proceeding more than I. Nay more, it is not necessary for him to give up more than a moderate share of his time to such studies, if they be properly selected and arranged, and if he be trained in them in a fitting manner.

I conceive the proper course to be somewhat as follows:—To begin with, let every child be instructed in those general views of the phenomena of nature, for which we have no exact English name. The nearest approximation to a name for what I mean which we possess is "physical geography." The Germans have a better, "Erdkunde" ("earth knowledge" or "geology" in its entomological sense), that is to say, a general knowledge of the earth, and what is on it, in it, and about it. If anyone who has had experience of the ways of young children will call to mind their questions, he will find that far as they can be put into any scientific category, they come under this head of "Erdkunde." The child asks, "What is the moon, and why does it shine?" What is this water, and where does it run?" "What is the wind?" "What makes the waves in the sea?" "Where does this animal live, and what is the use of

that plant?" And if not snubbed and stunted by being told not to ask foolish questions, there is no limit to the intellectual cravings of a young child; nor any bound to the slow but solid accretion of knowledge and development of the thinking faculty in this way. To all such questions, answers which are necessarily incomplete, though true as far as they go, may be given by any teacher whose ideas represent real knowledge and not mere book-learning; and a panoramic view of nature, accompanied by a strong infusion of the scientific habit of mind, may thus be placed within the reach of every child of nine or ten.

After this preliminary opening of the eyes to the great spectacle of the daily progress of nature, as the reasoning faculties of the child grow, and he becomes familiar with the use of the tools of knowledge—reading, writing, and elementary mathematics—he should pass on to what is, in the more strict sense, physical science. Now there are two kinds of physical science; the one regards form and the relation of forms to one another; the other deals with causes and effects. In many of what we term our sciences, these two are mixed up together; but systematic botany is a pure example of the former kind, and physics of the latter kind of science. Every educational advantage which training in physical science can give is obtainable from the proper study of these two; and I should be contented, for the present, if they added to our "Erdkunde," furnished the whole of the scientific curriculum of schools. Indeed, I conceive it would be one of the greatest boons which could be conferred upon England, if henceforward every child in the country were instructed in the general knowledge of the things about it—in the elements of physics and of botany. But I should be still better pleased if there could be added somewhat of chemistry, and an elementary acquaintance with human physiology.

So far as school education is concerned, I want to go no further just now; and I believe that such instruction would make an excellent introduction to that preparatory scientific training which, as I have indicated, is so essential for the successful pursuit of our most important professions. But this modicum of instruction must be so given as to ensure real knowledge and practical discipline. If scientific education is to be dealt with as mere book-work, it will be better not to attempt it, but to stick to the Latin grammar, which makes no pretence to be anything but book-work.

If the great benefits of scientific training are sought, it is essential that such training shall be real; that is to say, that the mind of the scholar should be brought into direct relation with fact; that he should not merely be told a thing, but be made to see, by the use of his own intellect and ability, that the thing is *so* and no otherwise. The great peculiarity of scientific training, that in virtue of which it cannot be replaced by any other discipline whatsoever, is this bringing of the mind directly into contact with fact, and practising the intellect in the completest form of induction; that is to say, in drawing conclusions from particular facts made known by immediate observation of nature.

The other studies which enter into ordinary education do not discipline the mind in this way. Mathematical training is almost purely deductive. The mathematician starts with a few simple propositions, the proof of which is so obvious that they are called self-evident, and the rest of his work consists of subtle deductions from them. The teaching of languages, at any rate as ordinarily practised, is of the same general nature,—authority and tradition furnish the data, and the mental operations of the scholar are deductive.

Again—if history be the subject of study, the facts are still taken upon the evidence of tradition and authority. You cannot make a boy see the battle of Thermopylæ for himself, or know of his own knowledge that Cromwell once ruled England. There is no getting into direct contact with natural fact by this road; there is no dispensing with authority, but rather a resting upon it.

In all these respects science differs from other educational discipline, and prepares the scholar for common life. What have we to do in every-day life? Most of the business which demands our attention is matter of fact, which needs, in the first place, to be accurately observed or apprehended; in the second, to be interpreted by inductive and deductive reasonings, which are altogether similar in their nature to those employed in science. In the one case as in the other, whatever is taken for granted is so taken at one's own peril; fact and reason are the ultimate arbiters, and patience and honesty are the great helpers out of difficulty.

But if scientific training is to yield its most eminent results, it must, I repeat, be made practical. That is to say, in explaining to a child the general phenomena of nature, you must, as far as possible, give reality to your teaching by object-lessons; in teaching him botany, he must handle the plants and dissect the flowers for himself; in teaching him physics and chemistry, you must not be solicitous to fill him with information, but you must be careful that what he learns he knows of his own knowledge. Don't be satisfied with telling him that a magnet attracts iron. Let him see that it does; let him feel the pull of the one upon the other for himself. And, especially, tell him that it is his duty to doubt until he is compelled, by the absolute authority of nature, to believe that which is written in books. Pursue this discipline carefully and conscientiously, and you may make sure that, however scanty may be the measure of information which you have poured into the boy's mind, you have created an intellectual habit of priceless value in practical life.

One is constantly asked, When should this scientific education be commenced? I should say with the dawn of intelligence. As I have already said, a child seeks for information about matters of physical science as soon as it begins to talk. The first teaching it wants is an object-lesson of one sort or another; and as soon as it is fit for systematic instruction of any kind, it is fit for a modicum of science.

People talk of the difficulty of teaching young children such matters, and in the same breath insist upon their learning their catechism, which contains propositions far harder to comprehend than anything in the educational course I have proposed. Again, I am incessantly told that we who advocate the introduction of science into schools make no allowance for the stupidity of the average boy or girl; but, in my belief, that stupidity, in nine cases out of ten, *fit, non nascitur*, and is developed by a long process of parental pedagogic repression of the natural intellectual appetites, accompanied by a persistent attempt to create artificial ones for food which is not only tasteless, but essentially indigestible.

Those who urge the difficulty of instructing young people in science are apt to forget another very important condition of success—important in all kinds of teaching, but most essential, I am disposed to think, when the scholars are very young. This condition is, that the teacher should himself really and practically know his subject. If he does, he will be able to speak of it in the easy language, and with the completeness of conviction, with which he talks of any ordinary every-day matter. If he does not, he will be afraid to wander beyond the limits of the technical phraseology which he has got up; and a dead dogmatism, which oppresses or raises opposition, will take the place of the lively confidence born of personal conviction, which cheers and encourages the eminently sympathetic mind of childhood.

I have already hinted that such scientific training as we seek for may be given without making any extravagant claim upon the time now devoted to education. We ask only for a "most favoured nation" clause in our treaty with the schoolmaster; we demand no more than that science shall have as much time given to it as any other single subject—say four hours a week in each class of an ordinary school.

For the present, I think men of science would be well

content with such an arrangement as this; but, speaking for myself, I do not pretend to believe that such an arrangement can be, or will be permanent. In these times the educational tree seems to have its roots in the air, its leaves and flowers in the ground; and I confess I should very much like to turn it upside down, so that its roots might be solidly embedded among the facts of nature, and draw thence a sound nutriment for the foliage and fruit of literature and of art. No educational system can have a claim to permanence unless it recognises the truth that education has two great ends to which everything else must be subordinated. The one of these is to increase knowledge; the other is to develop the love of right and the hatred of wrong.

With wisdom and uprightness a nation can make its way worthily, and beauty will follow in the footsteps of the two, even if she be not specially invited; while there is perhaps no sight in the whole world more saddening and revolting than is offered by men sunk in ignorance of everything but what other men have written; seemingly devoid of moral belief or guidance, but with the sense of beauty so keen, and the power of expression so cultivated, that their sensual caterwauling may be almost mistaken for the music of the spheres.

At present, education is almost entirely devoted to the cultivation of the powers of expression, and of the sense of literary beauty. The matter of having anything to say beyond a hash of other people's opinions, or of possessing any criterion of beauty, so that we may distinguish between the Godlike and the devilish, is left aside as of no moment. I think I do not err in saying that if science were made the foundation of education, instead of being, at most, stuck on as cornice to the edifice, this state of things could not exist.

In advocating the introduction of physical science as a leading element in education, I by no means refer only to the higher schools. On the contrary, I believe that such a change is even more imperatively called for in those primary schools in which the children of the poor are expected to turn to the best account the little time they can devote to the acquisition of knowledge. A great step in this direction has already been made by the establishment of science-classes under the Department of Science and Art—a measure which came into existence unnoticed, but which will, I believe, turn out to be of more importance to the welfare of the people than many political changes, over which the noise of battle has rent the air.

Under the regulations to which I refer, a schoolmaster can set up a class in one or more branches of science; his pupils will be examined, and the State will pay him, at a certain rate, for all who succeed in passing. I have acted as an examiner under this system from the beginning of its establishment, and this year I expect to have not fewer than a couple of thousand sets of answers to questions in physiology, mainly from young people of the artisan class, who have been taught in the schools which are now scattered all over Great Britain and Ireland. Some of my colleagues, who have to deal with subjects such as geometry, for which the present teaching power is better organised, I understand are likely to have three or four times as many papers. So far as my own subjects are concerned, I can undertake to say that a great deal of the teaching, the results of which are before me in three examinations, is very sound and good, and I think it is in the power of the examiners, not only to keep up the present standard, but to cause an almost unlimited improvement. Now what does this mean? It means that by holding out a very moderate inducement, the masters of primary schools in many parts of the country have been led to convert them into little foci of scientific instruction, and that they and their pupils have contrived to find or to make time enough to carry out this object with a very considerable degree of efficiency. That efficiency will, I doubt not, be very much increased as the system becomes known and perfected, even with the very limited leisure left to masters and teachers on week-days. And this leads me to ask, Why should scientific teaching be limited to week-days?

Ecclesiastically-minded persons are in the habit of calling things they do not like by very hard names, and I should not wonder if they brand the proposition I am about to make as blasphemous, and worse. But not minding this, I venture to ask, Would there really be anything wrong in using part of Sunday for the purpose of instructing those who have no other leisure, in a knowledge of the phenomena of nature, and of man's relation to nature?

I should like to see a scientific Sunday-school in every parish, not for the purpose of superseding any existing means of teaching the people the things that are for their good, but side by side with them. I cannot but think that there is room for all of us to work in helping to bridge over the great abyss of ignorance which lies at our feet.

And if any of the ecclesiastical persons to whom I have referred, object that they find it derogatory to the honour of the God whom they worship, to awaken the minds of the young to the infinite wonder and majesty of the works which they proclaim His, and to teach them those laws which must needs be His laws, and therefore of all things needful for man to know—I can only recommend them to be let blood and put on low diet. There must be something very wrong going on in the instrument of logic if it turns out such conclusions from such premises.

Fine Arts.

Art Decoration of Theatres.—The *Pall Mall Gazette* says:—"Those who wish to see the decorations and other accessory attractions at our theatres taking a higher artistic form than has hitherto been generally discernible therein, will be glad to learn that Mr. H. S. Marks, whose first production of the kind is nightly before the audiences at the Gaiety Theatre, has just executed a similar commission, on a somewhat larger scale, at the Prince's Theatre, Manchester. The design, which, as at the Gaiety, occupies the wall-space immediately over the proscenium, represents Shakspeare enthroned in the centre, Tragedy and Comedy seated at his feet, the space on either side being occupied by a group of characters from his greatest plays, happily varied and contrasted, both as to character and composition. Two sitting figures, Lear and Falstaff, occupy respectively the centre of each group, as representative of the extremes of tragedy and comedy, further typified by the blasted tree which adjoins the figure of Lear, and the flowering plant in full bloom which rises over the head of the jovial knight. The same contrast is kept up throughout; Romeo and Juliet, for instance, on the one hand, are balanced by Benedick and Beatrice on the other, and the graceful and refined figure of Desdemona is set off by the sturdy rusticity of Audrey. There is much thought, as well as some very fine drawing, in the composition, which exhibits specially the qualities which ought to characterise mural painting—viz., entire flatness of treatment in the colouring, without any attempt at perspective effect, and just that degree of conventional character in the figures necessary to prevent their appearing to compete obtrusively with the living actors strutting their hour upon the stage below. This painting may be considered as an important contribution to a style of art which has been far too little practised in this country, but of which our theatres and other public buildings afford abundance of opportunity."

Manufactures.

New Explosive Material.—The following account of a new explosive material is copied from the *Kölnische*

Zeitung, May 19th, which gives the *Militär-Wochen-blatt* as its authority :—"It is now some time since the proprietors of the Nora-Gyttorp Powder Mills obtained a patent in Sweden for the discovery of the so-called 'ammonia powder,' a substance which has hitherto been only employed in a few mining districts, but which otherwise seems wholly unknown. We are therefore fully justified in calling attention to the particular properties of this new explosive material. During the short time that it has been employed, it has won the approval not only of the proprietors of mines, but also of the working miners themselves. Its explosive force may be compared to that of nitro-glycerine, and, consequently, far surpasses that of dynamite. It cannot be exploded by a flame or by sparks, and the explosion is effected by a heavy blow from a hammer. Blast holes loaded with this powder are exploded by means of a powerful cap, or, better, by means of a cartridge containing common powder, for this forms a more reliable exploder. Miners who have been obliged to give up the use of nitro-glycerine, on account of the danger connected with this powerful explosive agent, have a most satisfactory substitute in the ammonia powder, as the danger of using it is so small that it surpasses in safety every other blasting material. One of the useful and important properties of this new powder is, that it does not require heating in cold weather, whilst nitro-glycerine and dynamite must first of all be warmed, and this has been the cause of many accidents. The price of the ammonia powder is the same as that of dynamite." The same paper further adds :—"According to information we have received, ammonia powder was discovered by the chemist Norrbin." The German "Building News" contains extracts from a report of the Prussian architect Steenke, who makes the following remarks upon the safety of ammonia powder :—"Experiments were made by fastening a lamp to a pendulum, which was caused to oscillate; gunpowder, gun-cotton, nitro-glycerine, and dynamite all took fire as the flame passed over them, but the ammonia powder did not begin to burn till it had been touched by the flame twenty times. In making experiments upon the force of the blow required to explode it, it was found that, with the apparatus employed, where the fall of a weight from 4 to 5 feet would explode gunpowder, nitro-glycerine only required 1½ to 2 feet, dynamite 2¾ to 3 feet fall, whilst a fall of from 12 to 15 feet was necessary to cause the explosion of the ammonia powder."

Commerce.

The Price of Cotton.—Mr. Sam Mendel's "Circular," dated August 2nd, says :—"The deficiency of some 400,000 bales in our visible supply of cotton, compared with last year, is a fact that cannot be overcome, and makes the raw material almost master of the situation; and, should consumption go on at the present rate, a further advance in prices can hardly be obviated. Not only will our stock be reduced to a low ebb, but the estimated extent of the growing crop does not seem to be such as to make buyers apprehensive of any serious decline, even after it becomes available; and holders of goods in foreign markets would do well to instil into the native mind the probable duration of the present comparatively high scale of prices. Cotton is now dearer than it has been since April, 1868, and as the prospects of supply have not improved, there is no ground for the expectation of lower prices, unless present values greatly interfere with the consumption of goods. It is generally admitted that any advance over a shilling per lb. for middling Orleans does have this effect, and I therefore expect to see some diminution in the production of goods over the next two or three months; and I do not think that exports to foreign markets for the second half of the year will exceed those in the first half."

Colonies.

Education in South Australia.—At the close of the year 1868, the number of schools conducted by teachers licensed by the Central Board of Education had increased to 325. Only one teacher is licensed to each school, but in most of the larger schools one or more assistant teachers or pupil teachers are employed. 15,259 children attended the public schools during the month of October, viz., 8,514 boys and 6,745 girls, showing an increase over the previous year of 274 boys and 385 girls; total increase, 659. Twenty-two schools were in Adelaide, 21 in corporate towns, 215 within the limits of district councils, 64 in hundreds, and three in outlying districts. The total number of buildings held in trust for school purposes under the board is now 78. The amount paid by the board in stipends to teachers was £16,680. The amount of fees received by the teachers from the parents was £14,214 8s. The destitute fees paid by the board amounted to £1,544 14s. Total cost of the education of the 15,259 children, £32,449 2s., or an average for each child of £2 2s. 6d., against £2 3s. 11d. for 1867.

Notes.

Social Science Congress.—The following are the special questions to be discussed at the forthcoming Social Science Congress, to be held at Bristol from the 29th of September to the 6th of October next :—Municipal Law Section—1. What ought to be the legal and constitutional relations between England and the Colonies? 2. What is the most expedient mode of introducing into England a system of public prosecution? 3. What limits ought to be placed by law to charitable endowments? Reformatory Section—1. Can infanticide be diminished by legislative enactment? 2. What have been the results of the Industrial and Reformatory Acts of 1866? Educational Department—1. Is an unsectarian scheme of education inconsistent with religious teaching? 2. How may the State best promote the education of the destitute and neglected portion of the population? 3. In what way can the Endowed Schools Bill be worked so as to bring the educational endowments within reach of all? Health Department—1. Can Government beneficially further interfere to limit the spread of infectious diseases? 2. What legislative measure might be proposed to deal with cases of uncontrollable drunkenness? 3. Should the Contagious Diseases Act be extended to the civil population? Economy and Trade Department—1. Is it desirable that State aid should be given to emigration, and, if so, in what form? 2. In what respects may the administration of the Poor-law be improved? 3. How may the condition of the agricultural labourer be improved? Voluntary papers on other subjects in connection with the departments will be taken.

Anthropological Museum in France.—The Minister of Public Instruction in France, some time since, founded a museum of anthropology, and confided its direction to M. Quatrefages, member of the Institute. This museum has just been enriched by a collection of types, life-size, of the natives of the Valley of the Nile, painted by M. Georges Lefébure, who has returned from a mission to the East.

Correspondence.

Velocipedes.—Sir,—Your *Journal*, vol. 17, p.p., 183, 200, 221, contains letters upon these machines, which, in their improved form, are deemed by the *Lancet* desirable for exercise, if not utility. I believe at Alnwick Castle a drawing is extant of a similar machine, made in the 17th century. In the *Journal de Paris*, 27th July, 1799,

Blanchard's velocipede was described. In 1818, the French invention was improved by Dennis Johnson, and dandy-horses were used, the riders striking the ground with their feet. In Wright's "History of the House of Hanover," the late Duke of York was represented on one of these machines. In March, 1819, "The road from Ipswich to Whitton, in Suffolk, was travelled every evening by pedestrian hobby-horses, six at a time; the distance, three miles, performed in 15 minutes." The machines consisted of two wheels, one before the other, connected by a perch, on which the pedestrian rested, urging the machine on the principle of skating. A Mr. Howard, of Bristol, invented a pedestrian chariot, to carry several persons. It was suggested that the new machines might be used for conveying light weights, as in the velocipedes. One step is only required once in five or six yards, and less on a declivity. At Ackerman's, in London, a model velocipede for females was exhibited, having two wheels behind, wrought by two levers, like weaver's treadles, on which the propeller of the machine pressed alternately, with a walking motion, sitting on the front seat. The treadles moved the axle by leather straps round the cramps, and the fixed wheels revolved with it. A writer in a public periodical (June, 1819) suggested that velocipedes might have been invented from the "go-carts" used in Wales, in parallelogram form; and that, where gain of time was desired, velocipedes or dandy-horses might be useful, as in the cases of postmen and medical men. At present this machine seems to be more adapted for recreation than utility, but may be improved, so as to become of practical benefit.—I am, &c., Christopher Cooke.

London, Aug. 10th, 1869.

Cotton Cultivation in India.—Sir,—The discussion on cotton has elicited from all sides such interesting information, bearing not only upon the highest interests of the inhabitants of India, and therefore of the government, but upon an enormous manufacturing population in this country, that I scarcely think it right I should withhold my small modicum of experience of agriculture and association with all classes of the population. One gentleman has told us that cotton, under good management, will produce £10 per acre, while, for the same land, the ryot, after deductions, can hardly be said to receive more than 25s. for his present crops. Now, after such a fact as this being admitted, can any one doubt the enormous value of the production of this staple to the people of that country, or the necessity and importance of making all considerations subsidiary to its production, which all profess to desire? It is said by some that efforts have been made and failed, to induce the native population to take to this profitable source of cultivation; but to me it appears very important to know by whom, and in what manner, these efforts were made. One gentleman said that, on the various appliances for the preparation of this article being introduced to the notice of the natives, they were much pleased, spoke very much in its favour, used them, but the moment your back was turned threw it aside, saying it was different from what they were accustomed to, and that their fathers and grandfathers did not use it. It is likewise said that Lord Tweeddale had taken great interest in improving the cultivation, with Sir E. Denison and other gentlemen, but that all had given the matter up in despair. Now, I must be pardoned for saying that I very much prefer an experiment, upon which such enormous results depend, being carried out by a practical person, intimate and acquainted with all the habits of the native population, and whose fortune, more or less, depends upon the result. We have incontestible evidence in that country of the success which has attended similar efforts when well and perseveringly directed. There are two stereotyped answers in the mouths of natives, throughout the length and breadth of India, when any change is wished for in their customs. The one is, that their fathers and grandfathers did not do it; the other, that they will lose caste if they attempt it; but experience constantly shows that these prejudices vanish when they get confidence in any profitable source of occupation. Silk printing and dyeing, the manufacture of sugar, indigo, and silk, and this very article of cotton-manufacture, have at various times, with marvellous success, been carried on by the native population. I visited, out of curiosity, the cotton-mills at Fort Gloucester, on the banks of the Hoogly, to the south of Calcutta, when they were in full working order. Two young men had come, I think from Glasgow, and I quite failed to learn that there was any inability or disinclination on the part of the native population to carry out the work as they required it. I saw the whole business of a cotton-mill in progress, precisely as I should expect to see it in this country. With regard to a former discussion, in which an impression existed that the native population could not reel silk as it was required, the solution of that apparent mystery was very simple. A practical gentleman told me it was a question of money; and when I asked what he meant, he said, to manipulate it as required they must dispense with the waste, and that they could not afford to do. Silk printing and dyeing was carried on by one of the eminent Calcutta mercantile houses at Hourah with great success; the natives there again acquired the art, and practised it with great efficiency, and I believe large sums of money were derived from it. If we turn to the preparation of indigo, we find precisely the same result, that is, an article which, during its whole process, requires the closest attention and greatest care, and yet the native, having been constantly and unceasingly tutored, does produce the finest article in the world without, if necessary, even the presence of the European. I am entitled to speak with some confidence on this matter, as although the value and quantity are small, I may say that on two occasions the very best in the country came from where I was, and partly belonged to me. Then, from the Mofussil or country districts of India I turn to the various capitals, and what do I find? I will go no further than Calcutta. Coach-makers, carpenters, tailors, shoe-makers, cabinet-makers, silversmiths, blacksmiths, &c., are there to be found acquitting themselves with marvellous cleverness, at a few rupees a month. I hope I have said enough to show that caste and prejudice are not so deep-seated in the native population as is generally supposed, and that they are not wanting in teachable ability. If I were asked my opinion, I should say, properly trained and taught, they were equal to the least advanced of European nations. I recollect hearing the well-known Dr. Duff say, in one of his splendid orations, that the great pioneer of Christian truth was the destruction of the caste; but I have known a Rajpoot and a Brahmin in my service, without being asked, when they saw my necessities, perform services which I knew to be utterly destructive of their caste. Can it be supposed for a moment that all that I have indicated has been accomplished, and that the natives, from any cause whatever, are incapable of further advancement. I believe it is a great injustice to them to suppose it. I now come to another portion of the subject. One gentleman, very properly, I think, looking at the character of the population, thought that the government ought to take an active part in this cotton cultivation, and he is met by the observation, that political economy forbids it. Another gentleman adverted to the contract law, and he is met by the assertion that all jurists have given their opinion that a breach of contract can only be met by a purely civil proceeding. Now, political economy is a science of yesterday, comparatively speaking, and has arisen entirely out of that advanced state of civilisation which we and other European nations enjoy, and it does seem singularly out of place to apply it to a people whose habits and customs are very like they were in the time of Alexander the Great. The population of India are not yet alive to the simple principle of supply and demand. I can supply many proofs of it, but will be satisfied with one. Take the article of sugar (I mean the date sugar), and I believe it is admitted that India

might supply the whole world at a fabulously small price, but the population do not enter into it, although it would cost them nothing; they have simply to plant the tree upon the divisions marking the boundaries of each piece of land; and yet in one district you see them, while in the next not a tree is to be found. I can understand fostering and improving in every possible way the native population, until they are fairly launched in a career of progress, and then leaving them in the hands of modern science in all its integrity. It has been stated at these conferences that it was remarkable how little hold we had obtained on the native population; that our rule was like the trees in the Himalaya mountains, whose roots took hold of the surface only, to be carried away by the first storm, and this said after you have had quiet possession of the country for a century and a quarter. I know no better way of inducing those roots to grow downwards than encouraging a great enterprise, such as cotton cultivation; and if I am asked for one of the best elements for the material progress of India, I should say it was an Englishman carrying on a cultivation of this remunerative character amongst hundreds and thousands of the native population, implanting in their minds the justice of all his transactions, settling their disputes, assisting them in their poverty, and exercising a wise discretion in all his relations with them, irrespective of all considerations of political economy, or the dictum of jurists. There are just three ways in which this cotton cultivation, it seems to me, can be carried out:—The one is, by the government taking up and carrying out the whole scheme, until it is matured and taken up by the natives; the other, that the parties interested should send out a commissioner and authorities of their own, on the distinct condition that they shall be effectually supported by the government, for, as has well been observed, the natives are very fond of authority, and more readily take to a novelty coming from persons in authority than any private individual; and the third is, that this shall be purely a matter of private enterprise. In the latter event, the only effectual way is to have a tenantry of your own, by underleasing an estate from a zemindar, where it is known there is a great deal more land in the hands of the ryots than they pay for, and where there is a good deal of excellent waste land, that the want of enterprise in the zemindar and the poverty of the tenant prevent being cultivated. In such an estate there ought to be a profit in the rental of five per cent., and much of the unpaid-for and uncultivated land might be utilised for cotton purposes; but I must emphatically warn those who may be interested in this matter from making large advances to the native population for these purposes. They may rest assured that the native mind is governed by two influences, fear and self-interest; that morality, truth, and honour are utterly unknown; that fraud, forgery, perjury, and the whole catalogue of vice which demoralise a community, flourish, and go very far to paralyze any efforts that may be made to reclaim them. I will just conclude with this, that if a proposition of this magnitude to that country and to this is to be looked upon coldly by authority, it is tantamount to saying that no further progresss can or ought to be made, by the population of a country who have shown, to those best able to understand them, that they are capable of unlimited advancement. — I am, &c., Maxwell Turnbull.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb. *Delivered on 10th August,* 1869.

167. (III.) Trade Accounts (Foreign Countries)—Belgium, Holland, France, and United States.
357. Weights and Measures (Metropolis)—Return.
385. Thames Conservancy—General Report.
National Education (Ireland)—Thirty-fifth Report.

Patents.

From Commissioners of Patents' Journal, August 20.

Grants of Provisional Protection.

Alcohol, &c., purifying—2364—W. E. Newton.
Candles, machinery for stamping—2095—L. Schalleidner.
Carriages, &c., sunshades for—2370—G. Ritchie.
Cast-iron, converting into malleable iron or steel—1100—J. B. Spence.
Cast-iron, &c., treating conglomerates of—2392—T. S. Blair.
Drills, &c.—2352—C. J. Chubb.
Eggs, apparatus for carrying or storing—2378—C. E. Brooman.
Fabrics, waterproofing—2398—C. D. Watson.
Fires, extinguishing—1661—J. M. Muterse and H. G. de Valory.
Gas-burners, &c., devices for holding the chimneys of—2354—W. R. Lake.
Harvesting machines—2358—W. Manwaring.
Knobs and spindles—2396—W. Wright.
Life-preserving dress—2348—E. Rihoux.
Liquids, apparatus for preserving while on draught—2406—F. H. Needham.
Lubricators—2400—J. Tenwick.
Manometers—2388—C. W. Zenger, C. L. Strube, and L. Merlett.
Marine propellers, &c.—23*0—H. Wimshurst.
Motive-power apparatus—2356—W. Tongue.
Numbering apparatus—2350—B. Hunt.
Numbers, apparatus for adding—2382—W. R. Lake.
Phosphate of ammonia, manufacturing—2408—A. M. Clark.
Pickers used in weaving—2376—J. Froggatt.
Railway rails, joints for uniting and securing the ends of—2366—A. B. Ibbotson.
Reaping and mowing machines, knives and knife bars for—2374—S. Osborn.
Safes and refrigerators—2384—R. Longdon.
Saw handles, &c., cutters used in the manufacture of—2362—H. Brandreth.
Stone, cutting and dressing—2390—J. E. Holmes.
Straw, &c., apparatus for raising and stacking—2360—G. Nickerson.
Velocipedes—2372—G. Rastall.

Inventions with Complete Specifications Filed.

Agricultural machinery, &c.—2435—E. H. C. Monckton.
Copper, extracting from its ores—2425—J. Lewis.
Gas retorts, machinery for charging—2416—W. R. Lake.
Signalling apparatus used in hand signal lamps—2421—E. J. Hill and R. Davis.
Tobacco, machinery for twisting—2438—T. Ward and W. S. Black.

Patents Sealed.

543. J. W. Reid.
544. W. R. Lake.
549. J. E. Liller.
560. J. Johnson and W. Gill.
567. W. E. Gedge.
571. W. Williams.
574. J. I. Vaughan.
577. J. T. Griffin.
596. J. Cheetham.
612. T. S. Blair.
615. R. S. Norris.
616. G. J. Snelus.
666. J. Gough.
692. C. Mather & W. Rossetter.
846. S. R. Wybrants.
929. H. Haschke.
963. B. Dobson and J. Eastham.
1054. J. Robbins and J. Allbut.
1284. H. Hall.
1466. H. Luke.
1516. C. Moseley.
1546. D. Roberge.
1929. J. Taylor, R. & J. Ingham and J. Sharples.

From Commissioners of Patents' Journal, August 24.

Patents Sealed.

592. H. J. Ledger.
610. J. H. Johnson.
617. L. G. Lysons.
704. A. Mitchell.
711. J. J. Shedlock.
712. J. J. Shedlock.
732. W. Weldon.
750. W. E. Newton.
774. W. H. Harfield.
778. E. W. and M. Slade.
780. C. Vero.
804. J. L. Norton.
969. G. Wells.
994. W. Allan.
1335. J. R. Jefferies.
1358. B. Hunt.
1443. B. J. B. Mills.
1557. Z. E. Coffin.
1790. G. Fry.
1804. W. E. Newton.
1899. W. R. Lake.
1948. W. H. Perkin.
2004. W. A. Biddell and J. Redgrave.
2009. P. G. Gardiner.
2048. F. Trappes.
2103. C. F. Dunderdale.

Patents on which the Stamp Duty of £50 has been Paid.

2069. E. A. Cowper.
2244. C. D. Abel.
2127. J. Varley.
2155. W. Tongue.
2160. J. Livesey and J. Edwards.
2174. J. B. Fell.
2136. W. Taylor.
2139. R. A. E. Scott
2069. E. A. Cowper.
2149. J. Longbottom.
2151. J. M. Hyde.
2168. W. Welch.
2192. G. Hunter & W. F. Cooke.

Patents on which the Stamp Duty of £100 has been Paid.

2331. J. Standish and J. Gooden.
2398. J. Davis.